

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Dominik Johannes Knoll


PhD Program: Engineering Systems

Title of Thesis: Model-based Processes and Tools for Concurrent Conceptual Design of Space Systems

Supervisor: Associate Professor Alessandro Golkar

Date of Thesis Defense: 31 January 2019

Name of the Reviewer: Professor Ighor Uzhinsky

<p>I confirm the absence of any conflict of interest</p> <p>(Alternatively, Reviewer can formulate a possible conflict)</p>	<p>Signature:</p>  <p>Date: 08-01-2020</p>
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The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

I. Brief evaluation of the thesis quality and overall structure of the dissertation.

The thesis presents a consistent approach to implementation of the Model-Based Systems Engineering (MBSE) for concurrent design of space systems. The proposed by the author approach has been offered as a well-structured methodology, being supported by a software tool, CEDESK, developed by the author in cooperation with a few of his colleagues at Skoltech. All assumptions have been well formulated in Chapters 2&3 of the thesis, followed by their systematic implementation along the rest of the presented paper. The structure of the paper matches the established goals.

Concerning the paper's content, I'd like to highlight a few items, that are at least questionable and I'd suggest to discuss these issues during the thesis defense:

1. One of the pillars of the author's design approach (page 22) is introduced as: "co-location in a shared workspace". But among multiple times listed later issues for implementation of the proposed methodology there are statements like (Page 83) "Despite the association that Concurrent Design is generally means co-location, it is very common to have remote participants. This is related to the limited availability of experts with specific knowledge." The point is that without experts with deep knowledge in the subject – the whole process cannot result in any valuable outcome. My personal experience is that the most part of these activities are done with remote online participation of the subject experts.
2. One of cornerstones of the introduced methodology is application of parametric modeling in the conceptual design process. The point is that there is a long way from developed descriptive models of the system (like, SysML-type) to the appropriate quantitative models. The only viable approach for the development of quantitative high-level models is to derive these models as meta-models from the more detailed first-principle based system models. So, integration of processes for selection or creation of the necessary first-principle system models with their subsequent parametrization is of high importance for the proposed methodology. These issues have not been addressed in the presented paper.
3. One of important results of the author's efforts is the development of the CEDESK software tool. It would be great to discuss B&C-s of using of this tool in comparison with, for example, NoMagic products, particularly after their integration within the Dassault Systemes 3D environment. Or with Phoenix Integration tools.

English language is one of distinct features of all Skoltech documents. We expect pretty high level of English language use, particularly in scientific papers. I'd recommend to run a thorough grammar check of the whole paper. For example, "it's" is used in multiple (dozens of) times instead of "its". "Its" – is a Possessive Pronoun and "It's" – is a short form of "It is". Obviously, these two items have very different meanings. Another point is use of masculine forms ("his", "he") instead of gender neutral ones (like "one's", "participant", and so on). There are some strange sentences in the paper, like "Different from existing tools, ..." (page 26) that should be re-written.

II. The relevance of the topic of dissertation work to its actual content

The dissertation's actual content addresses very well the topic claimed. The whole work presents a consistent and constructive approach to the proposed methodology.

III. The relevance of the methods used in the dissertation

The methods used are relevant to the stated goals.

IV. The scientific significance of the results obtained and their compliance with the international level and current state of the art

As it was stated above, the thesis presents the state-of-the art in the investigated research area with a comprehensive review of the work done. The reference list is very impressive.

V. The relevance of the obtained results to applications (if applicable)

The presented results are relevant to the stated goals and to the subject of investigation. Applications of the methodology are pretty impressive, including the presented particular use-cases done both by Skoltech students and by outside players. Applications of the methodology for the development of Technology Roadmapping seem to be promising.

VI. The quality of publications

The author's publications are of pretty high quality. The listed IEEE conferences are highly regarded in the relevant scientific community and they are usually well attended. The Concurrent Engineering Magazine, where Dominik's article, as the Main Author, was published is a highly ranked peer-reviewed Q1 journal with H Index 43: (<https://www.scimagojr.com/journalsearch.php?q=22078&tip=sid&clean=0>).

Provisional Recommendation

I recommend that the candidate should defend the thesis by means of a formal thesis defense

I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense